

Clay Spur Bentonite Plant and Camp  
Clay Spur Siding on the Burlington Northern Railroad  
4 miles northwest of Osage  
Weston County  
Wyoming

HAER No. WY-23

HAER  
WYO,  
23-OSAG.V,  
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record  
Rocky Mountain Regional Office  
National Park Service  
U. S. Department of the Interior  
P. O. Box 25287  
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

HAER  
WYO,  
23-0546.V,  
1-

Clay Spur Bentonite Plant and Camp

HAER No. WY-23

Location: Clay Spur Siding on the Burlington Northern Railroad,  
4 miles northwest of Osage, Weston County, Wyoming  
  
W-1/2/SW/NW/SW, SW/NW/NW/SW Section 30, T47N-R63W  
E-1/2/SE/NE/SE, SE/SE/NE/NE/SE Section 25, T47N-R64W  
  
UTM: A. 13/542060E/4874310N B. 13.541980/4874440  
C. 13/541980E/4874180N D. 13/542140/4874180  
Quad: Clay Spur, Wyoming, 7.5' (Prov. Ed. 1984)

Dates of Construction: ca. 1928, 1932

Present Owner: N. L. Baroid  
Alzada Star Route  
Belle Fourche, South Dakota

Present Use: Abandoned; site to be razed

Significance: The Clay Spur Bentonite Plant and Camp is associated with the early 20th century bentonite mining industry in Wyoming and the United States. It was one of the first bentonite processing plants built in the Clay Spur Bentonite District of Wyoming. Wyoming has consistently been among the top producers of the highest quality bentonite in the United States. The Clay Spur District was the center of the pioneer Wyoming bentonite industry and remained the premier Wyoming producing district until reserves began to dwindle in the 1950s. The plant also embodies the distinctive engineering technology of the bentonite industry. It is still possible to trace the milling process due to the machinery still in place. The associated company camp also reflects early twentieth century company town architecture with simple buildings and floor plans that could be quickly and cheaply constructed and adapted to many different uses.

Historian: Robert Rosenberg  
Historical Consultant  
  
July 1989

## I. HISTORY

### A. The Wyoming Bentonite Industry

"Bentonite is a rock formed from the alteration of volcanic ash and is composed chiefly of clay minerals."<sup>1</sup> Bentonite is damp in the ground and contains a moisture content of about thirty percent. In this state, it appears as soft, waxy, dark-olive gray. Near the surface where it has oxidized, it is usually a yellow-gray. The surface texture is wrinkled due to successive periods of swelling and shrinking that lend it an "alligator hide" appearance. Other surface indications of bentonite are popcorn-like mounds that develop from high-swelling bentonite.<sup>2</sup>

Bentonite deposits in the Clay Spur District was formed by successive depositions of volcanic ash from western volcanoes into a sea environment. The volcanic material fell to the sea floor and was eventually altered into bentonite.<sup>3</sup> The bentonite deposits are located within the Upper and Lower Cretaceous Epoch. They are called, in descending order, the Greenhorn bed and Brown bed in the Belle Fourche Shale; the Clay Spur bed and Lower Mowry bed in the Mowry Shale; and the Newcastle bed in the Newcastle Sandstone.<sup>4</sup>

Quality of bentonite is affected by the thickness of the overburden. As the bentonite layers become deeper with thicker overburden, their quality decreases. First class bentonite swells to many times its original volume when it comes in contact with water. It is this physical property that makes it attractive for numerous industrial uses. The bentonite deposits in Wyoming and specifically in the Black Hills region are first class and set the standard for bentonite in the United States.<sup>5</sup>

The existence of bentonite deposits was recognized by the Indians and the early pioneers in Wyoming. Both noted the formation of "soap holes" resulting from the wetting of the surface of a bentonite deposit. As a result, bentonite was called "mineral soap" or "soap clay." The Hudson Bay Company posts in Canada used a similar substance for washing blankets prior to 1873.<sup>6</sup> In present-day Wyoming, the first official documentation was made in 1858 by Engelmann, who described an outcrop on the north end of the Medicine Bow Range.<sup>7</sup>

William Taylor developed the first bentonite mine in 1888 near Rock Creek in Albany County. At that time, Taylor's mine was only one-quarter mile northeast of the Rock Creek Station on the Union Pacific Railroad. This portion of the line was later rerouted and abandoned. Taylor developed a bed ranging from four to five feet in thickness, with only a few inches of overburden, which was stripped away. The product was dug by hand, loaded onto wagons, and hauled to Wilcox, where it was shipped in box cars. Taylor's product was sold to eastern firms for the manufacture of hoof

packing to treat inflammation in horses' hooves. Taylor shipped an estimated 5,400 tons of bentonite from his mine prior to 1896. It sold for about \$2.50 per ton, with a total value of \$13,500. A second bentonite mine was developed by Doctor Linscott in 1897 about six miles south of Rock Creek, which produced about 160 tons of bentonite that year. Other mines were developed in the Laramie Basin area in the vicinity of Rock Creek, Hutton Lakes, Sand Creek, and on the Riverside Ranch.<sup>8</sup>

Bentonite was first described geologically by Professor W. C. Knight of the Wyoming School of Mines in 1898. It was originally given the name taylorite in honor of William Taylor, but later changed to bentonite after the Benton formation in which it was found. The name taylorite had already been used to describe another mineral.<sup>9</sup>

Apparently bentonite was not mined commercially in the Black Hills region until 1897. At this time, Messrs. Edgar and Thole began developing the bentonite deposits near Newcastle, which produced about twenty tons in that year. N. H. Darton described this deposit in 1904:

It occurs in considerable abundance in the Newcastle quadrangle and has been mined to some extent three-quarter miles east of Pedro Switch, a miles west of that place, and at a point three and one-half miles northwest of Osage on the east side of the railroad track.

...The mineral has been used with success as a soap filler and also in the manufacture of soap, but has proved most valuable as a packing for a special kind of horse shoe, and as a diluent for certain powerful drugs sold in powdered form.<sup>10</sup>

The bentonite deposits of the Clay Spur District were located along the mainline of the Chicago, Burlington and Quincy Railroad from Osage in a northwesterly direction to Moorcroft. Before the advent of the railroad in 1889, commercial development of these extensive deposits were unfeasible.

In 1904, bentonite had a market value of five dollars per ton. In addition to its use as a hoof dressing, bentonite was used to give body and weight to manufactured paper. Most of the output from Wyoming in the first years of the twentieth century was shipped to a paper mill in Denver, Colorado. Other less important uses at that time were in antiphlogistine, a dressing to remove inflammation, as an adulterant in candles and drugs, and in a preparation known as "Denver mud."<sup>11</sup>

The infant bentonite industry developed quite slowly due to limited markets, the long distance between known commercial deposits and industrial centers, and the high cost of refining the clay. Since bentonite is able

to absorb many times its own weight in water, it proved costly to wash and dry the raw bentonite. The small bentonite market became depressed after 1902 and, with the closing of many western paper mills, there was almost no production in 1905. Production figures are lacking up to 1919, when the industry began experiencing a rebirth. The price rose to seven dollars per ton and twenty-five railroad car-loads were shipped in that year. The first bentonite mill was installed at Cheyenne by the Owyhee Chemical Products Company around 1920. The plant dried, ground, and sacked the bentonite, which had been obtained near Medicine Bow.<sup>12</sup>

New uses and markets were developed for bentonite in the 1920s that caused the industry to make dramatic gains. The most important new use was as an ingredient in drilling mud. The increase in use of the rotary drilling rig in turn increased the demand for bentonite.<sup>13</sup> In a rotary drilling system, cuttings from the drill are removed "...by circulating fluid down the drill pipe over the bit, and back between the casing or wall of the hole and the outside of the drill pipe. Because of bentonite's water absorbing properties, it could be added to drilling mud to achieve a great savings in cost. The bentonite mud prevented gas and salt water from running into the drill hole, and prevented cave-in of material and absorption of the liquid into certain geological formations. The drilling mud served to plaster the walls of the drill hole, seal off the formations, and preserve circulation.<sup>14</sup>

By 1949, the chief uses for bentonite were as an ingredient in drilling mud and for preparing metallurgical molding sand of superior dry strength. At that time, only fifteen percent of the Wyoming bentonite product was used for other purposes. In the mid-1950s, a new market was developed in which bentonite was used as a bonding material in pelletizing taconite iron ore of the Lake Superior region. By 1980, Wyoming produced sixty-five percent of the bentonite in the United States. Of that total, thirty-three percent was used in pelletizing taconite iron ore; twenty-one percent was used for drilling muds; eighteen percent was exported to foreign markets; seventeen percent was used for foundry sands, and the remainder was used by a variety of small markets.<sup>15</sup>

Bentonite has a myriad of other uses--a list which continues to grow each year. It is still used as a filler for high grade paper. It is used in the ceramics industry for improving plasticity and strength of mixtures. It has also been found to increase the strength, reduce setting time, increase water tightness, and provide a smoother texture for Portland cement. The Silica Products Company at Clay Spur produced a cement additive known as "Aquagel." Bentonite has been used as a filler for phonograph records and electrical insulation. It also has valuable cleansing properties and is used in soaps and detergents, a property of which the early pioneers were well aware. Bentonite is used in coal mine dusting, water and sewage treatment, the refining of oils and fats, as an

ingredient in horticultural sprays, animal dips, insecticides, paints, enamels, inks, drugs, pharmaceuticals, and cosmetics.<sup>16</sup>

B. The Clay Spur Bentonite District

Due to the development of these new markets, the Clay Spur Bentonite District was first intensively developed starting in the late 1920s. Congressman Frank W. Mondell established the first bentonite drying mill at Clay Spur in 1928 to develop the nearby bentonite deposits, which had been mined by the Wyoming Bentonite Company almost as early as 1910. The company developed a three-foot bed of bentonite that had very little overburden. The product was used for foundry sand. A large storage building was erected along the railroad at Clay Spur prior to the construction of the mill to compensate for fluctuating demand or any disturbance in mining activity. Before the drying plant was built in 1928, the bentonite was shipped in raw form. The output in 1927 was placed at almost 3,000 tons. Around 1930, the Silica Products Company of Kansas City, Missouri, obtained the property from the Wyoming Bentonite Company. The company was a subsidiary of the National Lead Company, St. Louis, Missouri. It controlled over 1,300 acres of bentonite property near the plant and was one of the most important early bentonite companies in Wyoming.<sup>17</sup>

Also starting in the late 1920s, the Wyodak Chemical Company operated a bentonite processing plant at Jerome that handled bentonite from nearby deposits. The parent company was the Federal Foundries Supply Company of Cleveland, Ohio. Frank Mendenhall first exploited the bentonite at this location and shipped a few carloads for several years before selling the bentonite rights of his land holdings to Federal Foundries ca. 1928. The bentonite bed at this location was about three and one-half feet thick with very little overburden. As a result, the deposits were well oxidized and canary yellow in color. It was removed, using pick and shovel, and an elevator was used to load two trucks that delivered the products to a three-kiln dryer at Jerome Siding. The dryer was constructed about 1928 and used petroleum piped in from the nearby Osage Oil Field. From Jerome Siding, the dried product was shipped to Cleveland, Ohio, where it was ground and prepared for foundry use. In 1929, one pit had been excavated that was about 400 feet long and 8 feet wide, and a second pit had just been opened.<sup>18</sup>

In 1927, the American Colloid Company of Skokie, Illinois, began developing a bed of bentonite near Colloid Siding, about two miles northwest of Upton. It developed a bed of bentonite about three and one-half feet thick with little overburden which had "...a rich creamy yellow to greenish yellow color." By 1929, the company had developed two pits. As with the other operations, bentonite was removed from the bed with pick and shovel and loaded on trucks that delivered the product to a drying and preparation

mill only 250 yards away. The production of the operation was estimated at about 1,000 tons by 1929.<sup>19</sup> Bentonite in the Clay Spur District was mined using the open-cut or strip mine method (only one producer was documented to have used underground mining methods). By using auger tests, the thickness of the overburden, the underlying bentonite bed, and its quality can be determined in order to judge the economic viability of a prospective site. Most overburden is composed of shale and soft sandstone and is easily removed by earth-moving equipment, such as bulldozer-drawn scrapers and draglines or power shovels where the overburden is thick (horse-drawn scrapers were used in the pioneer day of the industry). Before World War II, the exposed bentonite was broken off the ledge with pick and shovel to assure a clean product. It was then loaded onto a small portable conveyor or directly onto waiting trucks or cars. More modern techniques involve ripping up the deposit to allow the fresh bentonite to partially dry in the pits. Other operators dry the bentonite in storage piles at processing plants. Because of the high moisture content of bentonite, it freezes quite easily in the winter and has to be blasted loose. Therefore, large reserves are stockpiled during the year to assure a steady winter supply to the processing plants. Wet weather also tends to hamper mining, as the workings become too muddy for hauling.<sup>20</sup>

As late as 1950, the Clay Spur District produced twenty-five percent of all bentonite mined in Wyoming. However, by 1960, the production fell to only fourteen percent, although the overall bentonite output for Wyoming increased to sixty-two percent of the nation's total production. During the 1930s, the pioneer bentonite companies in the Clay Spur District began developing new deposits in the Northern Black Hills District. These deposits were generally shipped eastward to Belle Fourche, South Dakota. A spur rail line was built to Colony, Wyoming, and processing plants were constructed along this line. Therefore, the slack in production by the Clay Spur District after 1950 was more than taken up by the Northern Black Hills District. The decline was due chiefly to a gradual depletion of the reserves.<sup>21</sup>

## II. THE CLAY SPUR BENTONITE PLANT AND CAMP

### A. The Milling Process

In 1928, Frank Mondell and the Wyoming Bentonite Company built a drying plant at Clay Spur. The Silica Products Company obtained the plant and associated bentonite claims in 1930. At the time of the purchase, the Clay Spur plant consisted of a large warehouse near the railroad tracks, a dryer building, a shop, a garage, an office, a mess hall, and a bunkhouse. The Silica Products Company soon began an ambitious program of development. In 1932, the entire plant was rebuilt and greatly expanded. The new plant was built on the site of the earlier plant and consisted of a new and

larger dryer building that modified the existing dryer furnaces, a green tank for storing raw bentonite material, a pulverizer building, four large dry storage tanks, a packer house, and two large finished products tanks. A power plant was also built at this time. The associated company camp with worker housing was also expanded.<sup>22</sup>

The materials and assembly drawings for the mill buildings and some of the camp buildings were provided by the Butler Manufacturing Company of Kansas City, Missouri. This firm built the famous metal "Butler" buildings that were used extensively throughout the United States in the 1930s and 1940s. The materials were shipped to the site by rail and assembled by workmen onsite. The mill buildings were probably designed and fabricated by the Butler Manufacturing Company to specifications provided by the Silica Products Company.<sup>23</sup>

The Silica Products Company equipped its bentonite mines with industrial tracks and open cars pulled by small engines that hauled the bentonite directly to its new processing plant. The train of cars climbed a specially designed ramp and dumped their contents into a common pit. The raw bentonite was then cut, dried, crushed, ground, and packed in bags for shipment. To achieve a uniform quality, the stockpiles were mixed and spread by bulldozer. At this point, the clay was still in large chunks, often high in moisture content (twenty-five to thirty percent). Bentonite in this condition passed through a clay slicer that cut the material in pieces two to three inches or less in diameter. Drier bentonite passed through rollers that broke down the materials. The bentonite was then passed over screens to achieve a size that could be readily dried or was returned to the rolls to be crushed into smaller sizes.<sup>24</sup>

The pieces were then dried in two large rotary oil-fired dryers. The colloidal value of bentonite could be destroyed by overheating, so great care was taken during the drying process. The dryers were equipped with continuous temperature recorders and were capable of carrying out a number of tasks, including conveying, stirring, counterflow heating, and removal of water by gas circulation. The dryers installed at the Clay Spur Plant were a L. R. Christy Dryer (70-inch diameter by 35 feet long), manufactured by the L. R. Christy Company of Pittsburgh, Pennsylvania, and a Darby Dryer (7 foot diameter by 45 feet long), manufactured by the Los Angeles Gas and Electric Corporation of Los Angeles, California.<sup>25</sup>

After drying, bentonite changed color from green to grayish-white and had an eight percent moisture content. The dry material was then ground, using ball mills, slug mills, rod mills, and mechanical mills, so that eighty-five percent of the product could pass through a 200-mesh screen. Some of the bentonite was ground to 300-mesh screen size, depending on the market being served. The finished product was stored in bins and fed mechanically to packing machines that automatically filled 100-pound paper

bags ready for shipment. The Silica Products Company maintained warehouse stocks in several major cities throughout the country from which prompt shipment could be made to customers, or shipments could be made directly from the plant at Clay Spur. This basic refining process remained essentially the same throughout the history of Clay Spur Plant, although the mill was expanded and machinery was added through the years.<sup>26</sup>

Wyoming bentonite production was not broken down into individual companies until 1949. By that time, the Clay Spur operation was listed as the Baroid Sales Division of the National Lead Company, or simply N. L. Baroid. From the 1950s through the early 1970s, N. L. Baroid employed from twenty to twenty-five workers. Production figures began to slip from 176,000 tons in 1956 to 46,000 tons in 1964. The figures fluctuated after 1964 until the closing of the plant in 1974 but stayed well under 100,000 tons. The mill operated from stockpiles until 1975 before closing permanently.<sup>27</sup>

#### B. Bill Modification

The Clay Spur Plant was expanded and machinery added or updated several times during its history. In spite of these modifications, both the mill and the company camp look much the same as in photographs published in a company brochure in 1934. The packer building next to the railroad tracks was expanded to the southeast in 1936 and in 1940. The pulverizer plant was extended 32 feet northeast in 1940, and a second roller mill was added. A standard gauge rail spur and track hopper were added in 1941 to allow for the processing of bentonite ore from other company locations. This facility replaced the small cars that once carried the bentonite ore directly to the mill from the adjacent pits. The railroad cars dumped their contents from the bottom into a large hopper below the track level, which in turn dumped its contents onto an elevated conveyor belt. The track hopper building was also manufactured by the Butler Manufacturing Company and assembled onsite. The power plant was expanded in 1941 and 1944 with the addition of three Caterpillar diesel generators, housed in tile lean-to additions to the original metal Butler building.<sup>28</sup>

The 1944 plant expansion was the most ambitious project since 1932. A new larger green tank and elevator replaced the old green tank, and the dryer building was expanded to the south. Raw bentonite was elevated from the track hopper into the green tank. From the green tank, the raw bentonite was carried into the two long rotary kilns for drying. A third mill and a fourth finished product tank were added to the northeast end of the pulverizer building. There are now three mills and four finished product tanks in this portion of the plant. The roller mills were manufactured by the Raymond Pulverizer Division of the Combustion Engineering Co., Inc., of Chicago, Illinois.<sup>29</sup>

C. Current Physical Description of the Clay Spur Bentonite Plant

The evolution of the Clay Spur Bentonite Plant and Camp is depicted in two scaled drawings of the Clay Spur layout dated 1940 and 1957 (see pages 14-15). The current layout of the mill complex and camp are shown on the accompanying site map of the Clay Spur Bentonite Plant and Camp (see page 17). Also see HAER No. WY-23-A through WY-23-S for descriptions of individual structures.

III. HISTORICAL SIGNIFICANCE OF THE CLAY SPUR BENTONITE PLANT AND CAMP

From its humble beginnings in 1888, the Wyoming bentonite industry grew to become the premier producer in the United States. The bentonite industry made its first significant gains in the 1920s when science developed many new uses for the product. The advent and general use of the rotary drilling rig and growth of the energy industry guaranteed an ever expanding market for bentonite as a drilling mud ingredient. During the 1940s, the bentonite industry made tremendous gains and set new production records each year. As the number of oil well starts continued to rise for the war effort, so did the market demand for bentonite. Secondly, as America toolled up for the war, there was an increase in demand for bentonite in foundry sands. By 1948, Wyoming produced forty-two percent of the total United States bentonite output, followed by South Dakota. In later years, new markets shifted demand to pelletizing taconite, and a substantial portion of the bentonite was exported to foreign countries. By 1973, 483 persons were employed in the Wyoming bentonite industry and, by 1980, Wyoming produced sixty-five percent of the total United States bentonite.<sup>30</sup>

Wyoming bentonite has become the standard by which all other bentonite is measured for quality. The Clay Spur District was the center of the pioneer Wyoming bentonite industry and remained the premier Wyoming producing region until reserves began to be depleted in the 1950s. Emphasis has now shifted to the northern Black Hills Deposits, which continue to keep Wyoming the foremost bentonite producer in the industry.

The bentonite industry has greatly benefitted the State of Wyoming, providing employment and revenues and aiding the Wyoming oil industry. In sparsely populated areas, such as Weston County, it has continued to provide a steady source of employment and a relatively stable economic base for the local communities such as Upton Osage, and Newcastle for over half a century. The myriad of uses for bentonite insures that it touches some aspect of daily life in America and throughout the world.

The Clay Spur Bentonite Plant and Camp is historically significant on a local and state level because it was one of the first bentonite processing plants built in the Clay Spur Bentonite District of Wyoming. The Clay Spur

District was the center of the pioneer Wyoming bentonite industry that grew to be the nation's foremost producer. The National Lead Company, Baroid Sales Division (also formerly known as the Silica Products Company) was one of the three largest producers in the Clay Spur District throughout its history. The Clay Spur Bentonite Plant and Camp operated nearly continuously and served the same function for almost half a century.

Because most of the equipment remains in place, it is still possible to trace the entire bentonite milling process at the Clay Spur Bentonite Plant. This process was first developed in the early twentieth century to suit the needs of a particular industry and remained essentially the same until the plant closed in 1975. The adjacent company camp, although quite small, reflects early twentieth century company town architecture and layout; that is, simple buildings and floor plans that could be quickly and cheaply constructed and adapted to many different uses. The change house represents architecture unique to the mining industry. In an isolated area prior to improved highway transportation systems, company housing was a necessity.

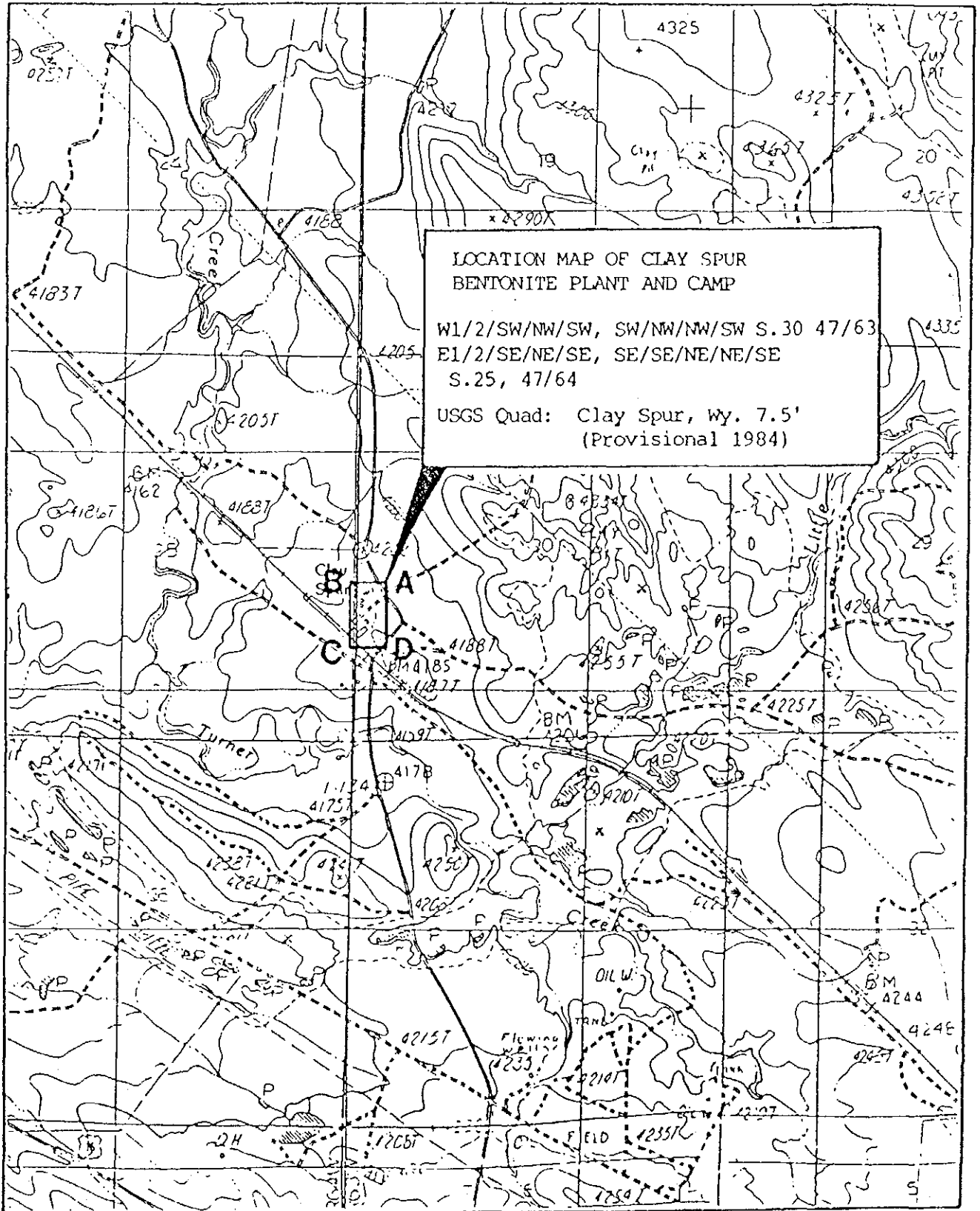
Finally, the Clay Spur Bentonite Plant and Camp retains good physical integrity and integrity of setting. This fact is verified by photographs of the plant and camp taken in the 1930s. Therefore, the site is able to convey feeling and association with its period of historical significance, i.e., the early twentieth century bentonite industry in northeastern Wyoming.

#### IV. FOOTNOTES

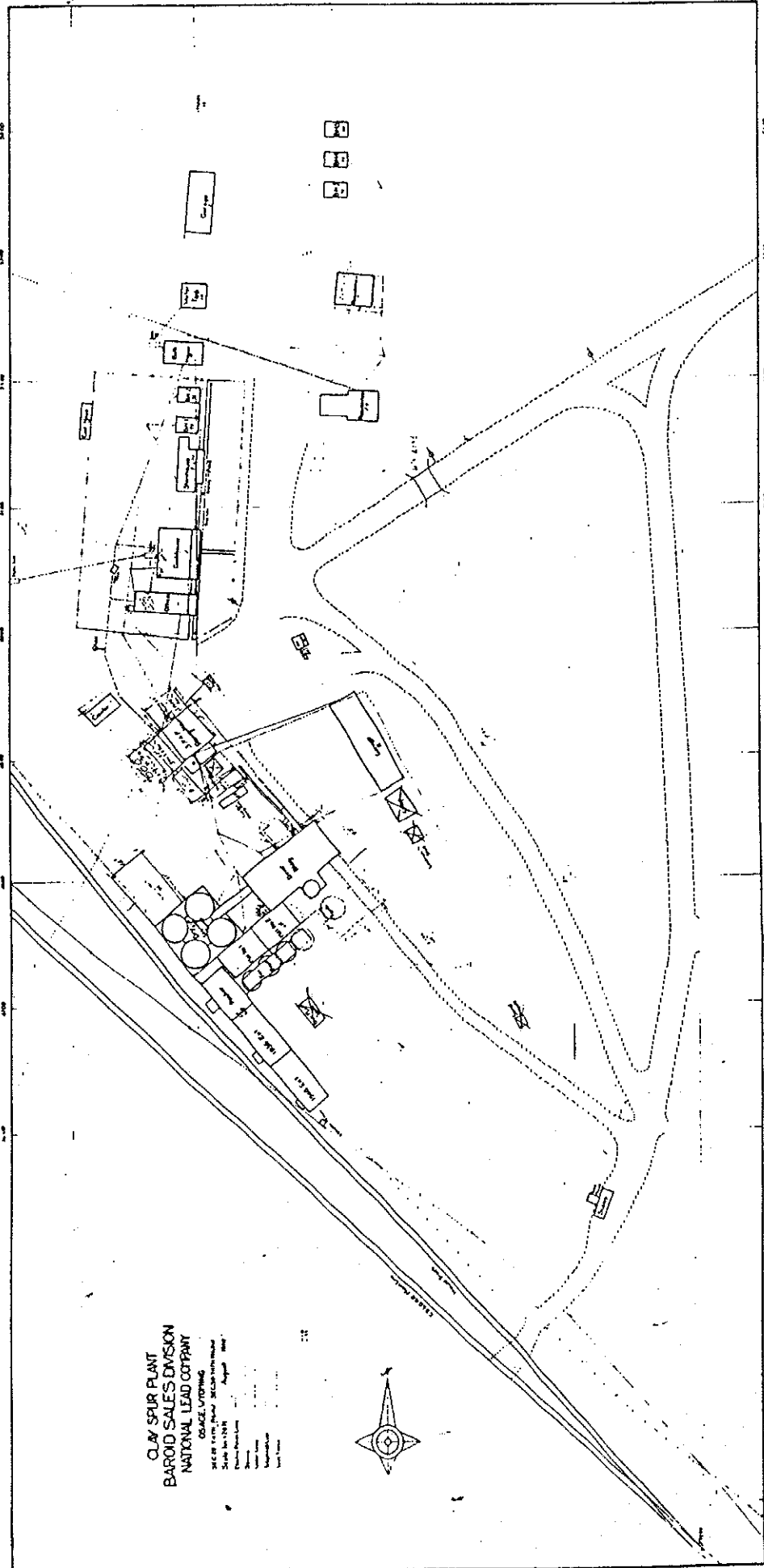
- 1 John C. Davis, "Bentonite Deposits of the Clay Spur District, Crook and Weston Counties, Wyoming," Geological Survey of Wyoming Preliminary Report No. 4, Laramie: University of Wyoming, 1965, p. 1.
- 2 Ibid., pp. 1, 10.
- 3 C. C. O'Harra, "Bentonite, Its Occurrence, Properties and Uses," Black Hills Engineer, Vol. 17, No. 1, 1929: 39.
- 4 Davis, "Bentonite Deposits of Clay Spur District," pp. 4-8.
- 5 Ibid., p. 10; J. H. Heathman, "Bentonite in Wyoming," Geological Survey of Wyoming Bulletin No. 28, Laramie: University of Wyoming, 1939, p. 4.
- 6 C. W. Davis and H. C. Vacher, "Bentonite: Its Properties, Mining, Preparation, and Utilization," U. S. Bureau of Mines Technical Paper No. 609, Washington: U. S. Government Printing Office, 1940, pp. 1-2.

- 7 Henry Engelmann, "Report of a Geological Exploration from Fort Leavenworth to Bryan's Pass, under Command of Lieutenant F. T. Bryan, Topographic Engineer, 1856," Report of the Secretary of War, 1857, 35th Cong., 1st session, Washington: U. S. Government Printing Office, 1858, p. 511.
- 8 C. A. Fisher, "The Bentonite Deposits of Wyoming," U. S. Geological Survey Bulletin No. 260-M, Washington: U. S. Government Printing Office, 1905), p. 563; C. E. Siebenthal, "Bentonite of the Laramie Basin, Wyoming," U. S. Geological Survey Bulletin No. 285, Washington: U. S. Government Printing Office, 1906, pp. 446-447.
- 9 Fisher, "Bentonite Deposits of Wyoming," p. 559.
- 10 N. H. Darton, "Newcastle Folio," Geologic Atlas U. S., Folio No. 107, U. S. Geological Survey, Washington: Government Printing Office, 1904, p. 9.
- 11 O'Harra, "Bentonite," p. 42; Siebenthal, "Bentonite of the Laramie Basin," p. 446.
- 12 Heathman, "Bentonite in Wyoming," p. 18.
- 13 Maxwell M. Knechtel and Sam H. Patterson, "Bentonite Deposits of the Northern Black Hills District, Wyoming, Montana, and South Dakota," U. S. Geological Survey Bulletin 1082-M, Washington: U. S. Government Printing Office, 1962, p. 893; Heathman, "Bentonite in Wyoming," p. 18.
- 14 H. G. Fiske, "Bentonite with Test Methods and Results of Tests in Wyoming Bentonite," University of Wyoming Natural Research Institute Bulletin No. 2, Laramie: University of Wyoming, 1946, p. 7; Silica Clay Products Company, Bentonite Handbook, Bulletin No. 107, Kansas City, Missouri: Silica Products Company, 1934, p. 31.
- 15 Knechtel and Patterson, "Bentonite Deposits of the Northern Black Hills," p. 893; Wyoming Department of Labor and Statistics, Wyoming Bentonite and Trona Industries, Cheyenne: Wyoming Department of Labor and Statistics, 1980, p. 7.
- 16 Davis and Vacher, "Bentonite," pp. 39-64; Harry T. Thorson, "Bentonite Non-Glamorous But It Has Thousand Uses," Wyoming State Tribune, Cheyenne, Wyoming, July 24, 1956.
- 17 Davis and Vacher, "Bentonite," p. 10; O'Harra, "Bentonite," p. 47; Thorson, "Bentonite Non-Glamorous."

- 18 Louis J. Falk, "The Bentonite Industry of Northeastern Wyoming," The Pepper Pot, June 2, 1929, pp. 27-51; O'Harra, "Bentonite," p. 47-48.
- 19 O'Harra, "Bentonite," p. 47.
- 20 Davis, "Bentonite Deposits of Clay Spur District," p. 2; Knechtel and Patterson, "Bentonite Deposits of Northern Black Hill," p. 899; Silica Products Company, Bentonite Handbook, p. 19.
- 21 Davis, "Bentonite Deposits of Clay Spur District," p. 2; Knechtel and Patterson, "Bentonite Deposits of Northern Black Hills, pp. 898-899.
- 22 N. L. Baroid Company, Clay Spur Plant Records, Clay Spur Layout Map Ca. 1930; General Layout, Silica Products Company, Clay Spur Plant, March 5, 1932 (Blueprint).
- 23 Idem., Set of Blueprints for 1932 Mill Construction.
- 24 Knechtel and Patterson, "Bentonite Deposits of Northern Black Hills, pp. 899-900; Silica Products Company, Bentonite Handbook, pp. 19-20.
- 25 N. L. Baroid Company, Clay Spur Plant Records, Christy Dryer File and Darby Dryer File.
- 26 Silica Products Company, Bentonite Handbook, pp. 19-20, 40.
- 27 State Inspector of Mines Annual Reports, 1949-1975.
- 28 N. L. Baroid Company, Clay Spur Plant Records (Various blueprints of expansion programs).
- 29 Idem., Raymond Mills File.
- 30 State Inspector of Mines Annual Report, 1973.



Clay Spur Bentonite Plant and Camp  
 HAER No. WY-23  
 (Page 14)






CLAY SPUR PLANT  
 BAROID SALES DIVISION  
 NATIONAL LEAD COMPANY  
 OGDEN, UTAH

SCALE 1/4" = 100' - 1948  
 DRAWN BY: [illegible]  
 CHECKED BY: [illegible]  
 DATE: [illegible]

COPY OF 1940 SITE MAP OF CLAY SPUR  
 BENTONITE PLANT AND CAMP FROM N.L.  
 BAROID COMPANY MAP FILES



SITE MAP LEGEND

-----	Site boundary
-----	Section line
---*---	Fences
=====	Poured concrete sidewalks and stoops
=====	Dirt roads
=====	Gravel roads
	Planted trees and shrubs
+	Power poles
	Camp buildings
	Refining mill buildings

WY-23-A	Wood frame stable
WY-23-B	Wood frame garage
WY-23-C	Wood frame water storage tower
WY-23-D	Concrete and tile bath house
WY-23-E	Butler Building bunkhouses/office/laboratory
WY-23-F	Wood frame laboratory
WY-23-G	Wood frame garage/storage building
WY-23-H	Butler storage building
WY-23-I	Wood frame and stucco dwelling
WY-23-J	Wood frame and stucco office
WY-23-K	Wood frame cooler
WY-23-L	Wood frame garage/machine shop
WY-23-M	Powerplant/machine shop & garage
WY-23-N	Wood frame oil house
WY-23-O	Bentonite refining mill
WY-23-P	Wood frame scale house
WY-23-Q	Wood frame and stucco 2-unit dwelling
WY-23-R	Wood frame and stucco 1-unit dwelling
WY-23-S	Wood frame outbuilding

